

An ADTRAN White Paper



The Basics of Internetworking

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Introduction

For small-to-medium size businesses, the idea of jumping into internetworking can be a daunting one. The term “internetworking” itself can conjure up images of big, expensive routers, high-speed switches, costly carrier services, and major management headaches.

While those images may indeed apply to a large enterprise internetwork supporting tens of thousands of end users, it doesn't have to be the case for the typical small-to-medium size business. It's helpful, then, to define exactly what internetworking means and how any company can simply and cost-effectively build an internetwork.

Most businesses have a local-area network, or LAN, that connects multiple PCs in an office to one another and to shared resources such as printers and servers. There comes a time, however, when a single LAN is not enough. Perhaps the company is growing – spreading out to different floors in the same building or opening branch offices, whether they are across town or across the country.

In such cases, you need a way to connect separate LANs to one another. This allows end users whose computers are attached to one LAN can seamlessly communicate with those on another LAN. Simply put, connecting two or more LANs to one another is internetworking.

The manner in which you connect your LANs will depend on your requirements. If it's a matter of connecting a LAN located on one floor of a building to another LAN on the floor just above, a simple switch will likely do the trick. Switches enable multiple LAN devices to be interconnected for more efficient bandwidth utilization by breaking up collision or broadcast domains when VLANs are configured or a Layer 3 switch is used. That means all devices on the LAN are effectively sharing the same bandwidth.

Things get a bit more interesting when you need to connect LANs that are in geographically separate buildings. This scenario requires some form of carrier services to transport data between locations.

Carrier service options

Here's where the small-to-medium size business is faced with a number of options. The most common options are leased lines, Frame Relay, and Internet services.

A leased line is dedicated bandwidth that users essentially “rent” from a carrier for a fixed monthly fee. That fee will vary depending on the capacity, or bandwidth, of the line – which may range from 56K to T1 (1.54M) or more – as well as the distance it travels. The advantage of leased lines is that bandwidth is dedicated, meaning the line is not shared with any other user. The full capacity is available at all times. Also, it does not matter how much or how little the line is used, the monthly price remains the same.

Frame Relay is a newer service that gives users more options in terms of how much capacity they lease. Users can sign up for a service that provides a minimum guaranteed capacity, known as the Committed Information Rate (CIR), but allows them to “burst” above that one occasion to the full bandwidth of the connection. For example, a Frame Relay link may have a CIR of 56K, but allow, bursts up to T1 speed, to handle the occasional massive file transfers.

Frame Relay services are generally less expensive than private lines, in part because multiple users essentially share the same carrier circuits. Because not all users on a single trunk will send bursts of data at the same time, carriers can oversubscribe their trunks. Customers are still guaranteed they will have access to whatever their CIR is, and can often burst far above that – all for less money than comparable leased lines.

In the past few years, Internet services have emerged as another viable alternative. This is by far the least expensive scenario, because the user needs only a relatively short connection to an Internet Service Provider (ISP), often via a high-speed digital subscriber line (DSL) or a cable modem connection. From there, data travels over circuits that are shared among many Internet users. This enables carriers to offer the service at far less expense. The very “openness” that makes the Internet an inexpensive option brings with it a major drawback: security. On one hand, users need to ensure that other Internet users cannot see their data in transit. There is also the issue of

protecting the internal corporate network against attacks that come in via the Internet connection. How to address these security concerns is discussed later in this paper.

Equipment requirements

Today, more than ever, network reliability and efficiency are paramount to business success. A healthy network infrastructure lowers the cost of bandwidth, speeds service delivery, reduces response time in competitive situations, and positions a company to respond to new opportunities. Basically, it is a business necessity.

How does one manage this challenge while respecting the reduced spending and significantly higher ROI threshold that are characteristic of today's IT world? A complete internet-working offering includes products that can equip a remote or branch office with WAN access and products that allow interconnectivity of Local Area Network devices. Vendors that offer access routing, Ethernet switching, and firewall/VPN appliances allow network managers to equip their network from the WAN to the desktop with a single vendor solution. This simplifies network administration and lowers the cost of network infrastructure. The right equipment converts any network into a flexible and cost efficient resource – one that accommodates new technologies without forklift upgrades, and bridges legacy systems to updated technologies.

Access Routing

Usually for Frame Relay and leased lines, customers deploy routers. Routers shuttle data from one LAN to another by looking at information contained in the header of each data packet to determine its destination. Routers will vary dramatically in terms of their size, measured in both total bandwidth capacity and in the number of interfaces they offer, for attaching LANs and wide-area links. They also vary in terms of function, be it management features or the transport and routing protocols they support.

ADTRAN™'s NetVanta™ 3000 Series of access routers offers a feature set that helps small-to-medium size businesses cost-effectively jump into internetworking. These devices are designed to enable branch offices to connect to Frame Relay networks at up to T1 speed – typically more than enough for

the average small-to-medium size business. ADTRAN offers three models in the NetVanta 3000 Series, the standalone NetVanta 3200 and the rackmount 3205 and 3305. All are modular devices that support 10/100BaseT Ethernet connection(s) on the LAN side and hold one of four different Network Interface Module (NIMs) for the WAN side: 56/64K, T1/Fractional T1 (FT1), T1/FT1 with a DSX-1 voice interface, and a serial NIM.

Each NIM holds an optional Dial Backup Interface Module (DIM) that supports an ISDN Basic Rate Interface (BRI) or an analog modem connection for disaster recovery, should the primary link fail. Users can mix and match NIMs depending on their requirements at each location. For example, a headquarters site may need the full T1 connection to a Frame Relay network while branch locations need only a 56K Frame Relay connection. Or, users can employ the NIM with integrated DSX-1 support, providing the ability to carry voice traffic over the Frame Relay link and drop it off to a local PBX, thereby saving on telephony charges.

These devices are also “Internet-ready”, with support for features including an integrated stateful inspection firewall, network address translation (NAT), and DHCP client and server. Firewalls protect users against unauthorized Internet intruders while NAT allows users to conserve IP addresses by hiding all internal IP addresses behind one “public” address. DHCP simplifies the administration of IP addresses.

Finally, NetVanta 3000 Series routers employ a familiar Command Line Interface (CLI), which is immediately recognized by an experienced network administrator. This familiar CLI eliminates the need for retraining or costly certifications.

LAN Segmentation: Ethernet Switching

Like routers, another key element of today's networks is Ethernet switches. These devices provide LAN segmentation and interconnectivity for Ethernet devices such as hubs and personal computers. The utilization of Ethernet switches results in more efficient bandwidth usage by breaking up collision domains and alleviating congestion. Switches, while similar in function to bridges, offer more intelligent functionality and provide faster performance.

Using industry-standard switching protocols, ADTRAN's NetVanta 1000 Series Ethernet switches provide interoperability and ease of integration into existing or multi-vendor networks. These full-featured products are designed for networks requiring a managed switching solution for LAN interconnectivity or network segmentation, including Fast Ethernet and Gigabit Ethernet applications.

These products support Layer 2 switching in a cost-effective, easy-to-deploy rackmount chassis. Both products support Fast Ethernet ports. The NetVanta 1224ST also supports dual Gigabit uplink ports for high-speed link redundancy and stacking capability for up to 16 units or 384 ports. These products easily integrate into switching closets, computer rooms, or network operation centers. Utilizing standards-based switching technology, these devices may be used in multi-vendor networks for new or existing installations.

For users migrating to new applications, such as VoIP, network managers need to prioritize mission-critical or delay-sensitive traffic. The NetVanta 1224 and 1224ST offer inherent Quality of Service (QoS) functionality. These products benefit the user with a variety of data security features including multi-level user passwords, encrypted user login, and secure authorization for RADIUS server applications.

Building a VPN

Customers that want to employ Internet services instead of Frame Relay or private lines will likely want to build a Virtual Private Network (VPN). VPNs solve the security problem inherent with using the Internet, by enabling users to build private "tunnels" through the Internet that connect two or more locations. All data sent through the tunnels is encrypted, so that even if an intruder manages to capture data packets they will be unintelligible.

ADTRAN offers the NetVanta 2000 Series of VPN/Security gateways that address requirements for large corporate host locations, mid-size branch offices, and small office/home office (SOHO) applications. The Series is complemented by

the NetVanta VPN Client, a software-based VPN that is ideal for telecommuter/mobile worker applications. It offers a personal firewall for laptops and personal computers, allowing for secure remote access to the corporate network. All the products support VPN tunneling based on the IPSec standard, which promotes interoperability with other vendors' VPN products. The NetVanta 2000 Series has been certified by the VPN Consortium, a leading industry authority on VPNs. This certification testifies to NetVanta's interoperability with other leading VPN products (see www.vpnc.org).

ADTRAN Offers A Complete Solution

Coupling NetVanta Ethernet switches with ADTRAN access routers, VPN/firewall devices, Integrated Access Devices (IADs), and bandwidth management appliances, provides a complete WAN-to-the-desktop solution. This single-vendor approach is an added advantage for customers, because it streamlines management and service of the equipment.

No matter which internetworking products you choose you will benefit from ADTRAN's unmatched warranty. Most vendors offer a very limited warranty (typically one year or less), ADTRAN backs its internetworking products with a full five-year North American warranty.

ADTRAN – A Company You Can Trust

As ADTRAN continues to expand its offerings in the internetworking arena, it brings to the table a history of success in the network equipment business. Customers that are concerned about the health of their equipment providers can take comfort in the fact that ADTRAN has 17 consecutive years of profitability. With established and loyal distribution channels and a finely tuned service and support organization, you can be assured that ADTRAN will stand behind its products over the long haul.



About ADTRAN™

ADTRAN, Inc. is an established supplier of advanced transmission products for today's expansive telecommunications networks. Widely deployed in carrier, CLEC, enterprise, and global networks worldwide, ADTRAN products support all major digital technologies including fiber, T3, T1, E1, wireless T1/E1, ATM, Frame Relay, VPN, SHDSL, SDSL, HDSL, HDSL2, ISDN, and DDS. According to Gartner/Dataquest and IDC, ADTRAN has gained the leading market position in enterprise integrated access devices and HDSL, while maintaining its leadership position for the fourth year in a row in T1 and subrate DSU/CSUs, Frame Relay/DDS extension, and ISDN extension. ADTRAN equipment serves the major Incumbent Local Exchange Carriers, interexchange carriers, ISPs, Competitive Local Exchange Carriers, international service providers, public and private enterprises, and original equipment manufacturers.

ADTRAN, Inc.

901 Explorer Boulevard
Huntsville, Alabama 35806
P.O. Box 140000
Huntsville, Alabama 35814-4000

800 9ADTRAN 256 963-8000 voice
256 963-8004 fax
info@adtran.com email
www.adtran.com website



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